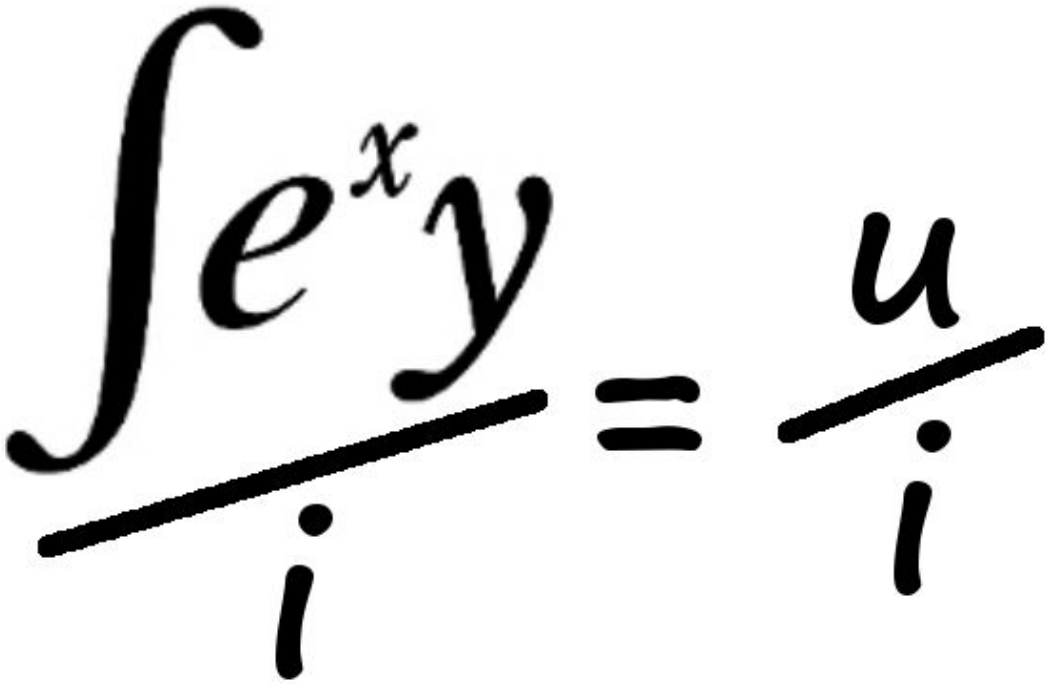
You + Me = Sry.
Math Too Hard 4 Me



Hour 6
99th Semi-Annual Williams Trivia Contest
January 15th-16th, 2016
Presented By: Honey Bunches of Scrotes
Sponsored by: Goodrich Coffee Bar

Find your self-respect now. Don't dumb yourselves down. Think of yourself as capable and worthy of finding a guy who is going to respect you, too. It's so important, I mean, and the confidence you get from feeling smart and tackling something like mathematics, which is a challenge, right? Math is hard." - Danica McKellar

Winter Study is a time for relaxing and forgetting all that you have learned in your past life (read: Fall Semester). But some things never go away. Mathematics permeates all that we do and all that which we observe. So join us on a journey towards greater enlightenment as we add up the factors of our life to determine the true meaning of this world. Oh, and in honor of Winter Study, we definitely end with some trashy Rom Coms, no worries!

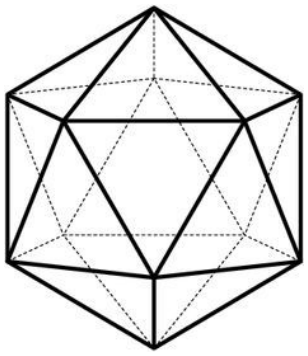
Note: This Boni is worth up to 15 points. If you use the Internet it is worth up to 5 points. Please indicate whether you used the internet on your answer sheet!

I. Lay Tangent to My Curves ;)

Match the geometric figure to its name. (e.g. find the letter on the accompanying sheet and match it to the correct geometric figure by writing the letter after the figure name)

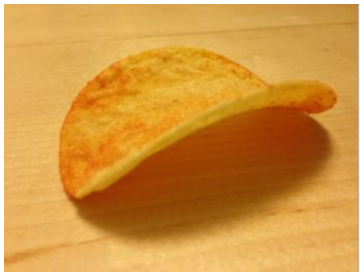
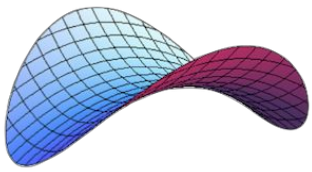
1. Hyperbolic Paraboloid
2. Catenary
3. Brachistochrone
4. Cycloid
5. Parallelepiped
6. Icosahedron
7. Torus
8. Solenoid
9. Mobius Strip
10. Trefoil Knot
11. Square

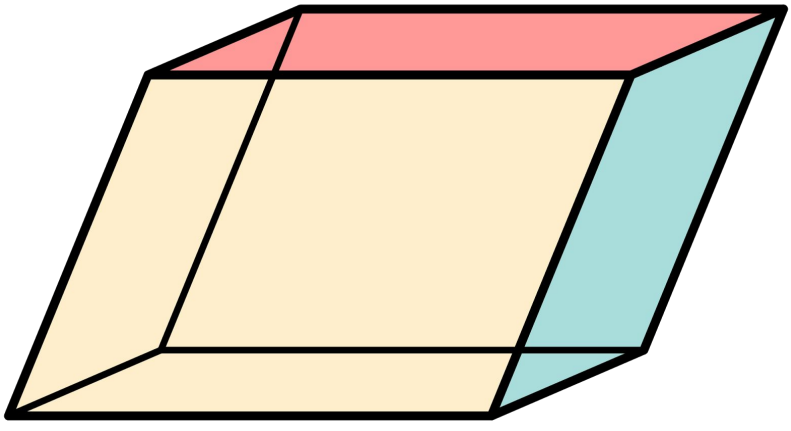
Geometric Figures

A. 

B. 

C. 

D.  

E. 

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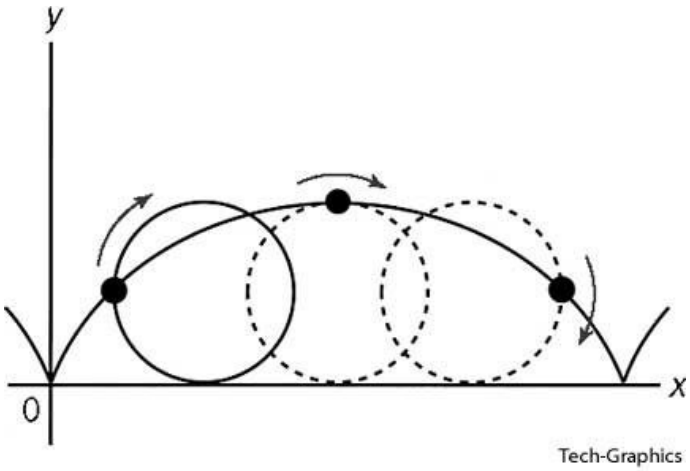
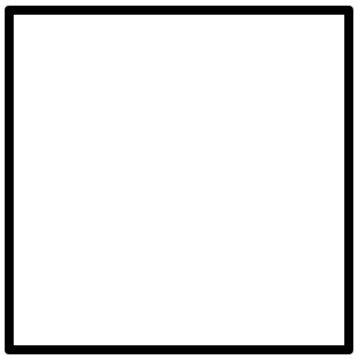


G.



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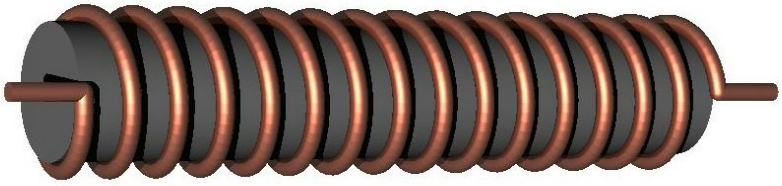
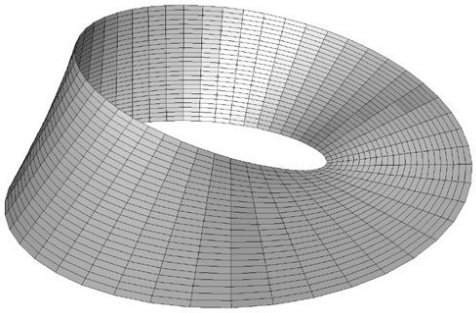
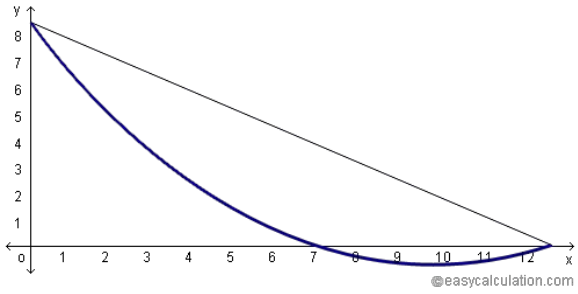


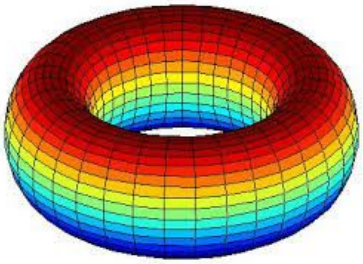
I.



J.



K.



II. We're a Perfect Fit… Theoretically

Match each theorem to its statement (e.g. find the letter on this sheet and match it to the correct equation writing the letter after the theory name)

Theorems Names:

12. Fundamental Theorem of Calculus
13. Fundamental Theorem of Algebra
14. Taylor's Theorem
15. Stoke's Theorem
16. Spectral Theorem
17. Euler's Theorem
18. Godel's Incompleteness Theorem

19. Abel's Theorem
20. Ham Sandwich Theorem

Theorem Pictures:

A.

Let $a = \{a_k: k \geq 0\}$ be any sequence of real or complex numbers and let

$$G_a(z) = \sum_{k=0}^{\infty} a_k z^k$$

be the power series with coefficients a. Suppose that the series $\sum_{k=0}^{\infty} a_k$ converges.

Then

$$\lim_{z \to 1^-} G_a(z) = \sum_{k=0}^{\infty} a_k, \qquad (*)$$

B. **Let $k \geq 1$ be an integer and let the function $f : \mathbb{R} \to \mathbb{R}$ be k times differentiable at the point $a \in \mathbb{R}$. Then there exists a function $h_k : \mathbb{R} \to \mathbb{R}$ such that:**

$$f(x) = f(a) + f'(a)(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \cdots + \frac{f^{(k)}(a)}{k!}(x-a)^k + h_k(x)(x-a)^k,$$

and $\lim_{x \to a} h_k(x) = 0$. This is called the Peano **form of the remainder**.

C.

Let f be a continuous real-valued function defined on a closed interval $[a, b]$. Let F be the function defined, for all x in $[a, b]$, by

$$F(x) = \int_a^x f(t)\, dt.$$

Then, F is uniformly continuous on $[a, b]$, differentiable on the open interval (a, b), and

$$F'(x) = f(x)$$

for all x in (a, b).

D. Given *n* measurable "objects" in *n*-dimensional space, it is possible to divide all of them in half (with respect to their measure, i.e. volume) with a single (*n* − 1)-dimensional hyperplane.

E. Integral of a differential form ω over the boundary of some orientable manifold Ω is equal to the integral of its exterior derivative dω over the whole of Ω, i.e.,

$$\int_{\partial\Omega} \omega = \int_{\Omega} \mathrm{d}\omega.$$

F. If *n* and *a* are coprime positive integers, then:

$$a^{\varphi(n)} \equiv 1 \pmod{n}$$

where φ(*n*) is the totient function.

G. Every non-constant single-variable polynomial with complex coefficients has at least one complex root.

H. No consistent system of axioms whose theorems can be listed by an "effective procedure" (i.e., any sort of algorithm) is capable of proving all truths about the relations of the natural numbers (arithmetic).

I. **Suppose *A* is a compact self-adjoint operator on a Hilbert space *V*. There is an orthonormal basis of *V* consisting of eigenvectors of *A*. Each eigenvalue is real.**

III. Picture This!

Match the pictures of the physicist with their name and his/her Nobel-worthy achieve (e.g. find the correct picture and achievement and write down the appropriate letter in the appropriate columns). Achievements can be used more than once.

Physicist

21. Albert Einstein
22. Marie Curie
23. Gustav Hertz
24. C.V. Raman
25. Wolfgang Pauli
26. Paul Dirac
27. Wolfgang Pauli

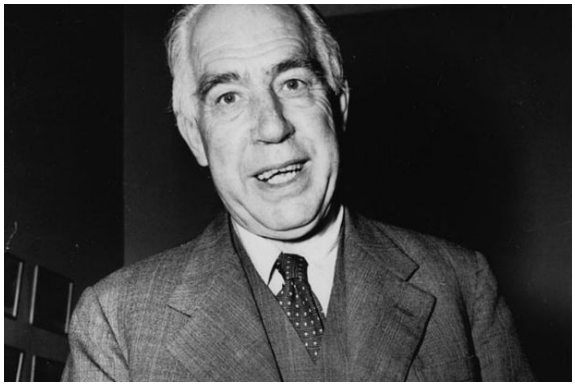
28. Niels Bohr
29. Hendrik Antoon Lorentz
30. Richard Feynman
31. Edward Mills Purcell
32. Peter Higgs
33. Max Planck
34. Wilhelm Röntgen
35. Max Born
36. Erwin Schrödinger
37. Enrico Fermi

Physicist Pictures

A. 

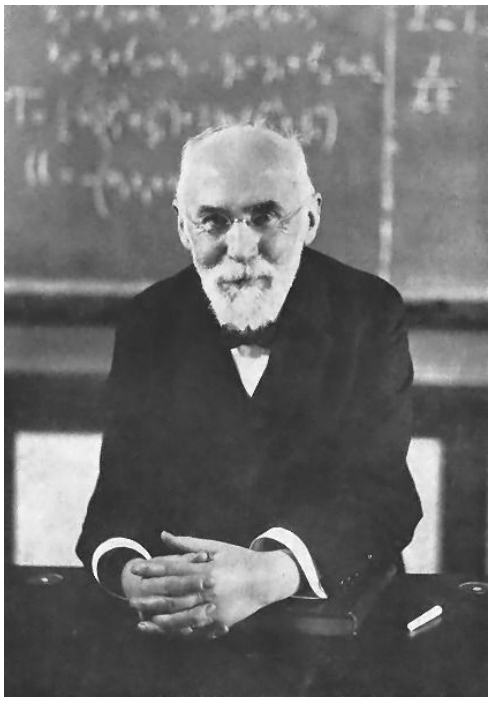
B. 

C. 

D. 

E. 

F. 

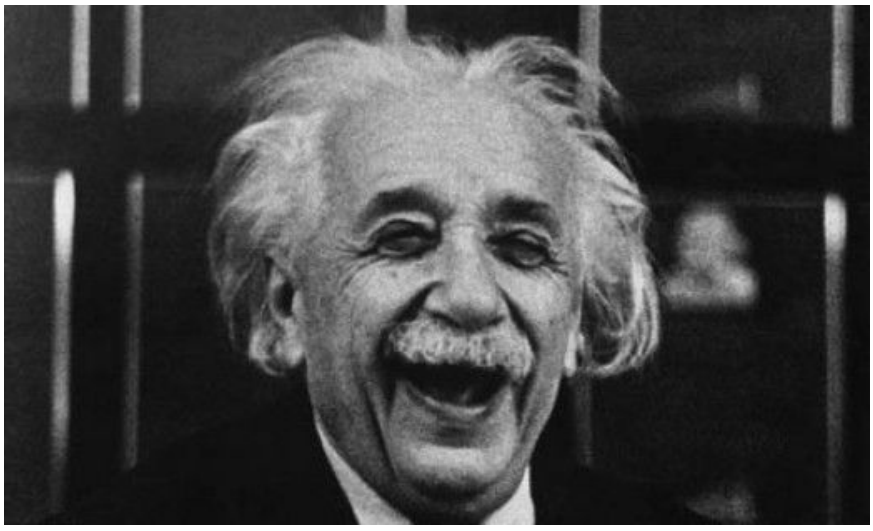
G. 

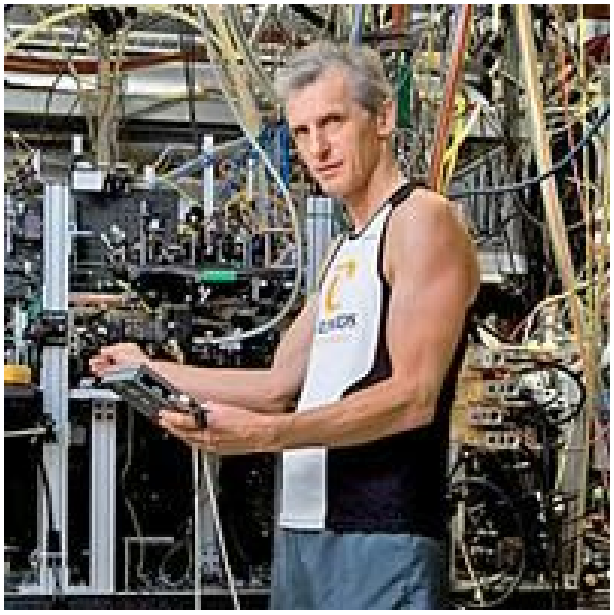
H. 

I. 

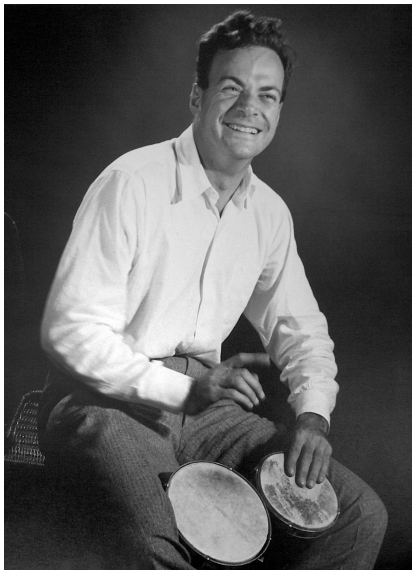
J. 

K. 

L. 

M. 

N. 

O. 

P. 

Q. 

Reasons for Nobel Prize:

A. **1945** - "for the discovery of the Exclusion Principle" -
B. **1938** - "for his demonstrations of the existence of new radioactive elements produced by neutron irradiation, and for his related discovery of nuclear reactions brought about by slow neutrons"
C. **1954** - "for his fundamental research in quantum mechanics, especially for his statistical interpretation of the wavefunction"
D. **1901** - "in recognition of the extraordinary services he has rendered by the discovery of the remarkable rays subsequently named after him"
E. **1965** - for "fundamental work in quantum electrodynamics, with deep-ploughing consequences for the physics of elementary particles"
F. **1918** - "in recognition of the services he rendered to the advancement of Physics by his discovery of energy quanta"
G. **1933** - "for the discovery of new productive forms of atomic theory"
H. **2013** - "for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider"
I. **1903** - research "on the radiation phenomena discovered by Professor Henri Becquerel"
J. **1952** - for the "development of new methods for nuclear magnetic precision measurements and discoveries in connection therewith"
K. **1925** - "discovery of the laws governing the impact of an electron upon an atom"
L. **1921** - "for his services to Theoretical Physics, and especially for his discovery of the law of the photoelectric effect"
M. **1922** - "for his services in the investigation of the structure of atoms and of the radiation emanating from them"
N. **1902** - research "into the influence of magnetism upon radiation phenomena"
O. **1930** - "for his work on the scattering of light and for the discovery of the effect named after him"
P. **2001** - "for the achievement of Bose-Einstein condensation in dilute gases of alkali atoms, and for early fundamental studies of the properties of the condensates"

IV. 1+1=2 ;)

Fill out the missing information in this table about Romantic Comedies (films and TV shows)!

Title	Lead Romantic Actor	Lead Romantic Actress	Male Character	Female Character	Year	City It Takes Place In	Female Lead's Profession/ Career
(38)	Tom Hanks	Meg Ryan	Sam Baldwin	Annie Reed	1993	(39)	(40)
The Mindy Project	Chris Messina	(41)	(42)	Mindy Lahiri	2012	New York	Doctor (OB/GYN)
Bridget Jones's Diary	Colin Firth	(43)	(44)	Bridget Jones	(45)	(46)	TV journalist
(47)	(48)	Meg Ryan	Joe Fox	Kathleen Kelly	(49)	New York	Owns a Children's Bookstore
(50)	Hugh Grant	Julia Roberts	William Thacker	(51)	1999	London	(52)
Four Weddings and a Funeral	(53)	Andie MacDowell	Charles	(54)	1994	London	(55)
Sliding Doors	John Hannah	(56)	James	Helen	1998	(57)	(58)
(59)	James Marsden	Katherine Heigl	Kevin/ Malcolm Doyle	(60)	(61)	(62)	Office Assistant
Maid in Manhattan	(63)	Jennifer Lopez	Chris Marshall	(64)	2002	New York	Hotel Maid
(65)	Matthew McConaughey	Jennifer Lopez	Steve Edison	Mary Fiore	2001	(66)	(67)
(68)	(69)	Jennifer Garner	Matty Flamhaff	Jenna Rink	(70)	New York	Works at a Fashion Magazine
When Harry Met Sally	(71)	Meg Ryan	Harry Burns	Sally Albright	(72)	New York	Journalist
Roman Holiday	(73)	Audrey Hepburn	Joe Bradley	Princess Ann	(74)	(75)	Princess of Hungary
(76)	(77)	Audrey Hepburn	Linus Larrabee	Sabrina Fairchild	1954	(78)	Unemployed/ Studying to be a Chef
(79)	Bill Murray	(80)	Phil Connors	(81)	1993	Punxsatawney, PA	TV News Producer